September 4, 2018

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COMMENTS: Research findings about pesticide drift from orchard airblast sprayers

Dear Pesticide Application Safety Workgroup,

Thank you for the opportunity to provide public comments for workgroup members. We would like to reiterate comments made by Dr. Richard Fenske, Associate Director of the Pacific Northwest Agricultural Safety and Health (PNASH) Center, at the first workgroup meeting on June 21, 2018:

- Health Impact Review: This is an excellent report that covers the relevant literature and issues common to Washington, Oregon, and California.
- Pesticide Use Reporting: California has benefited from their system, but findings there cannot always be imported to Washington. We need our own data and are at a point technologically that would make reporting possible and cost-effective without imposing a great burden on the agricultural community.
- Notification: In our review of notification systems around the world, we found that a grower-to-grower notification system—much like the one in Kern County—could facilitate communication between adjacent properties and prevent pesticide drift exposure among workers in Washington.
- Pesticide Incident Reporting and Tracking (PIRT) Panel: A regular, public forum with state agencies, research universities, and stakeholders would provide a valuable mechanism to continue the current conversation about the latest pesticide safety information that has been started by this workgroup.
- Bilingual Pesticide Label: We have developed a smartphone application that translates the health and safety information on tree fruit pesticide labels into Spanish. The app is an educational tool that helps Washington pesticide handlers know how to keep themselves safe and reduce the possibility of drift.

We would also like to share a summary of our findings from a series of pesticide spray drift studies conducted in 2015 and 2016 in collaboration with Washington State University (WSU).

OVERVIEW OF PESTICIDE SPRAY DRIFT STUDIES

Spraying procedures. An axial fan airblast (AFA) sprayer was used to treat an orchard block in central Washington on six days in June, July, and September. The sprayer was calibrated to apply commercial agricultural products that contained micronutrients (zinc, molybdenum, and copper). AFA spraying occurred for approximately 25 minutes on each of the spray days.

Wind conditions. Wind speeds during the spray events, as measured by the WSU AgWeatherNet station at the study site, fell within the 3-10 miles/hour range as recommended by the U.S. Environmental Protection Agency. Wind direction was consistently from the north, blowing from the sprayed area to the sampling area.

Passive sampling. We followed applicable ISO and ASABE drift sampling guidelines for this study. On each study day, 45 drift samples and 6 reference samples made of 6-meter polyester (PE) lines were hung vertically from masts in an orchard work environment (Figure 1). At the end of spraying, each PE line was cut into three 2-meter sections and sent to the laboratory for analysis. Micronutrients captured by these samplers were quantified through laboratory analysis. Laboratory values (mass micronutrient/sample) were then converted to volume of tank spray (µL) captured by each sample, as is common in drift studies.

Real-time aerosol monitoring. Real-time aerosol monitors (Dylos DC 1100 Pro) were also placed in the orchard work environment on four of the six spray days (Figure 1). These monitors count particles in size-selective bins. In our analysis, the bins were combined and the particle counts were converted to particle mass.

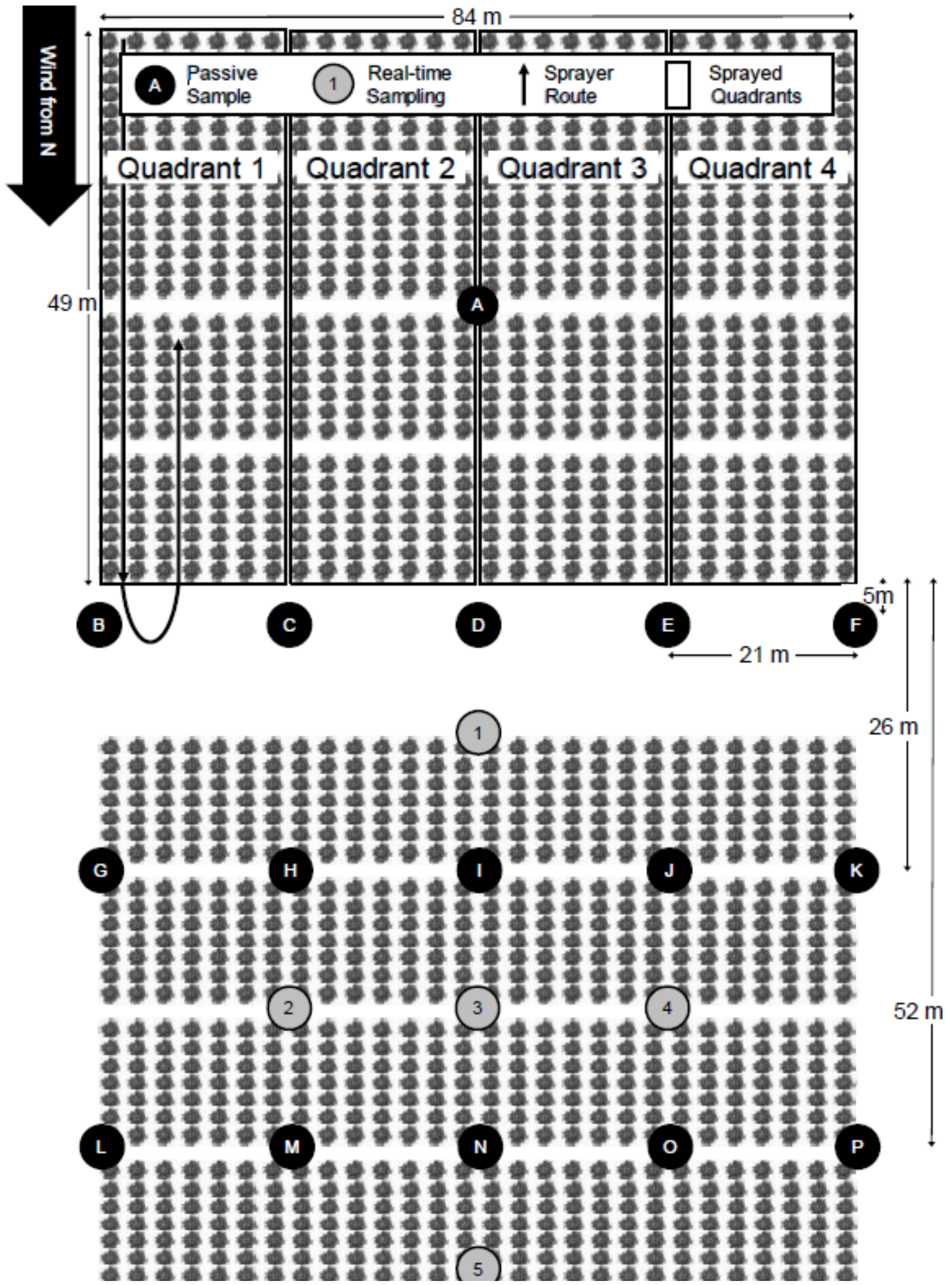

Figure 1. Field diagram showing northern block with four randomly sprayed quadrants, and an unsprayed southern block that was used for sampling. Each passive sampling location consisted of 6-m masts with three 2-m sections of polyester line at 0-2 m, 2-4 m, and 4-6 m. Masts B-P were organized in a grid downwind of the sprayed block. Real-time drift sample locations were Masts 1-5. Each real-time sampling location had two Dylos monitors (above and below canopy) collecting one-minute particle number concentrations (PNC) of four bin sizes (0-1.0 µm, 1.0-2.5 µm, 2.5-10 µm, >10 µm) throughout a spray day.

KEY FINDINGS

Passive sampling. The passive sampling measurements for all six spray days were combined into three distance categories – 16 feet, 85 feet, and 170 feet – from the southern edge of the sprayed orchard block. Results are presented in Table 1.

Table 1. Spray volumes (µL) collected on passive PE line samples from axial fan airblast spraying over six days. Control values are from a PE line sample upwind of spraying.

Distance from orchard block (feet) [meters]	Number of samples	Arithmetic mean	Arithmetic standard deviation	Geometric mean	Geometric standard deviation
16 [5]	90	310	216	257	1.8
85 [26]	90	66	42	52	2.0
170 [52]	86	28	24	20	2.3
Control	15	12	12	10	1.9

These data indicate that spray volume intercepted by the PE line samples decreased with distance from the sprayed orchard block, as expected. For example, the arithmetic mean was much higher at 16 feet than at either 85 feet or 170 feet. More relevant to the issue of the Agricultural Exclusion Zone, the data also indicate that spray drift still occurred at least 170 feet from the southern edge of the sprayed orchard block. This finding was consistent across all six spray days.

Real-time aerosol monitoring. The particle mass concentrations measured by the aerosol monitors were also combined for the four sampling days and divided into three distance categories. Results are presented in Table 2.

Table 2. Mean particle mass concentrations (µg/m^3) in the sampling area. Control values were collected during non-spray times at the beginning and end of each spray day.

Distance from orchard block (feet) [meters]	Number of samples	Arithmetic mean	Arithmetic standard deviation	Geometric mean	Geometric standard deviation
51-109 [16-33]	14	261	231	181	2.5
110-175 [34-53]	84	119	128	64	3.4
176-244 [54-74]	41	62	58	36	3.4
Control	37	12	7.2	9.8	1.8

These data indicate that the mass of the particles counted by the aerosol monitors decreased with distance from the sprayed orchard block, similar to the findings with the passive sampling. Measurements with these monitors also indicate that drift occurred at distances over 100 feet from the southern edge of the sprayed orchard block. Particle mass concentrations in the furthest distance category (176 -244 feet) were substantially higher than concentrations measured during control periods.

CONCLUSIONS

Systematic evaluation of sprayers is essential for developing recommendations about pesticide spray drift and worker safety in an orchard work environment. Spray drift from an axial fan airblast sprayer, which was measured with two different methods, occurred at distances beyond the U.S. Environmental Protection Agency's Application Exclusion Zone of 100 feet for airblast spraying. Additional studies may demonstrate that tower sprayers appear to be a promising means by which to decrease drift levels through shorter nozzle-to-tree canopy distances and more horizontally-directed aerosols that escape the tree canopy to a lesser extent. Substitution of these new technologies for AFA sprayers, e.g. through an "AFA buyback" incentive program, could stimulate wider adoption of new drift-reducing spray technologies and reduce the frequency and magnitude of pesticide drift exposures and illnesses.

Sincerely,

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